fedcloudclient webinar

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Introduction

fedcloudclient is a simple but powerful client tool for working with OpenStack sites in EGI Cloud infrastructure:

- Simple: setup in one minute, no privileges required, intuitive syntax
- Powerful: can work with all sites, all VOs, customisable, extensible, advanced options
- Federated: considers EGI Cloud infrastructure as a whole, sites and VOs are just parameters of the client

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1. Initial setup

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Initial setup

- Install fedcloudclient
  - Using pip3:
    ```
    $ pip3 install -U fedcloudclient
    ```
  - or using Docker:
    ```
    $ docker run -it  tdviet/fedcloudclient bash
    ```
- Get access token from EGI Check-in https://aai.egi.eu/fedcloud/, or from oidc-agent and set environment variable for it:
  ```
  $ export OIDC_ACCESS_TOKEN=<access token>
  ```
  or
  ```
  $ export OIDC_AGENT_ACCOUNT=<agent-account>
  ```
- And that is all. You are ready to use fedcloudclient to manage your resources in EGI Cloud

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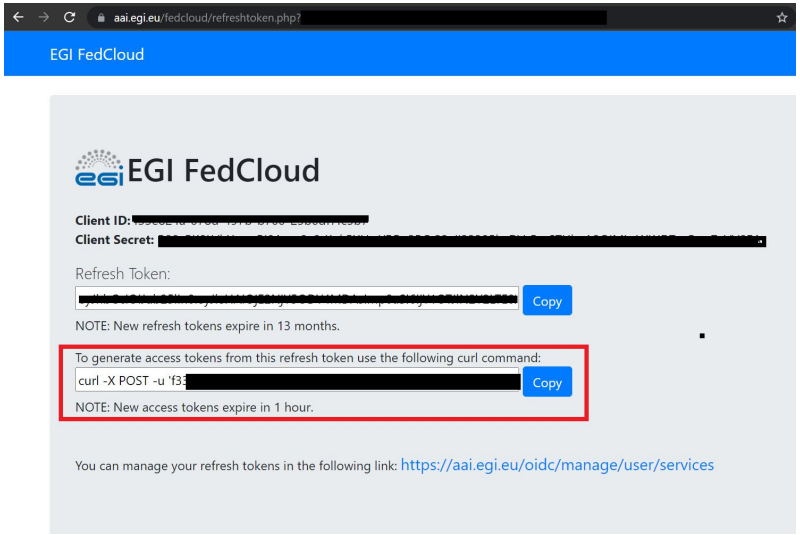
Getting access tokens from https://aai.egi.eu/fedcloud/

- Access tokens are generated using the command in red rectangle
- Tokens are shown in clear text => no demo here
- Access tokens are expired in one hour, need to generate it again => not recommended for production




```
$ curl -X POST -u 'xxxx':'xxx'  -d 'grant_type=...

{"access_token": "THIS IS THE ACCESS TOKEN", "token_type": ..."}

$ export OIDC_ACCESS_TOKEN="THIS IS THE ACCESS TOKEN"
```

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Getting access token from oidc-agent

Secure and comfortable way for saving tokens, strongly recommended for production:

- Works like password manager or SSH agent, no exposing tokens anymore
- Register an account only once with a simple command on PC

```
$ oidc-gen --pub --issuer https://aai.egi.eu/oidc --scope "eduperson_entitlement email" egi
```

- Load the account before used (can be added to ~/.bashrc)

```
$ eval `oidc-keychain --accounts egi` && export OIDC_AGENT_ACCOUNT=egi
```

- The agent refreshes access tokens automatically when expired

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2. Basic usage (live demo here)

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List VO memberships

```
$ fedcloud token list-vos
eosc-synergy.eu
fedcloud.egi.eu
training.egi.eu
...
```

- The VO memberships are taken from access token and EGI Check-in

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List available sites

```
$ fedcloud site list
100IT
BIFI
CESGA
...
```

- By default, the site configurations are taken from GitHub repository
- But users can save them locally for faster loading (and for customisation)

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Execute OpenStack commands on site/VO

```
$ fedcloud openstack image list --site IISAS-FedCloud --vo eosc-synergy.eu
Site: IISAS-FedCloud, VO: eosc-synergy.eu
+--------------------------------------+-----------------------------------------------------+--------+
| ID                                   | Name                                                | Status |
+--------------------------------------+-----------------------------------------------------+--------+
| 862d4ede-6a11-4227-8388-c94141a5dace | Image for EGI CentOS 7 [CentOS/7/VirtualBox]        | active |
...
```

- Main parameters: site, VO and OpenStack command “image list”
- Work with all sites in federation: site and VO are just parameters
- Native OpenStack commands and syntaxes

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More OpenStack commands

- Frequently used OpenStack commands:
  - Managing VMs: server list, server show, server create, server delete, ...
  - Managing images: image list, image show, ...
  - Managing volumes: volume list, volume show, ...
- For full references of OpenStack commands, check: https://docs.openstack.org/python-openstackclient/latest/cli/command-list.html

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Interactive work with OpenStack

```
$ fedcloud openstack-int --site IISAS-FedCloud --vo eosc-synergy.eu
(openstack) server list -c Name -c ID
+--------------------------------------+------------------------------------------------------+
| ID                                   | Name                                                 |
+--------------------------------------+------------------------------------------------------+
| 973ef1ce-c078-47b6-89ac-f78a99b1b735 | simple-node-103d2e10-1f7c-11eb-9d3e-06bfee50c33a |
+--------------------------------------+------------------------------------------------------+
(openstack) image list -c Name -c ID
+--------------------------------------+-------------------------------------------------------------------------+
| ID                                   | Name                                                                    |
+--------------------------------------+-------------------------------------------------------------------------+
| 7fc6d894-9f53-45ac-8d88-d6091a60d9d7 | Image for NVIDIA Docker CentOS 7 [CentOS/7/KVM]                         |
| cc665eca-edb4-4cb6-8bf3-cb804256606e | Image for ScipionCloud v3.0 [Ubuntu/18.04/VirtualBox]                   |
+--------------------------------------+-------------------------------------------------------------------------+
(openstack) flavor list -c Name -c ID
```

- If users need to execute multiple OpenStack commands on the same site/VO, interactive mode is more efficient (faster execution, less typing)

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3. Customisation

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Customisation

- fedcloudclient should work out-of-the-box for EGI Federated Cloud without any customisation
- However, users can customise it for:
  - Faster loading (save local config, delete unusable sites)
  - Supporting for new sites/VOs/identity providers
  - Solving problems of IGTF certificates that are not included in default OS distribution
  - Trying all features provided by the client
- This section is mostly for customising the fedcloudclient installed via pip3. If using fedcloudclient via Docker container, go to Section 4.

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Install IGTF certificates

- Some OpenStack sites use certificates issued by national certificate authorities that are not included in the default OS distribution (IGTF certificates).
- If you receive error message "SSL exception connecting to https:// ...", follows instruction from https://github.com/tdviet/python-requests-bundle-certs
- For Python virtual environments, just download and execute:

```
$ wget https://raw.githubusercontent.com/tdviet/python-requests-bundle-certs/main/scripts/install_certs.sh

$ bash install_certs.sh
```

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Customise site configurations

```
$ fedcloud site save-config
Saving site configs to directory /home/viet/.config/fedcloud/site-config/
```

- Saving site configuration to local disk will make fedcloudclient loads faster as it will read local data instead of remote repository
- Users can customise local site configurations by editing the files, e.g.
  - Delete sites that users do not have access
  - Add new sites that are not fully integrated with EGI Cloud infrastructure
  - Add new VOs that are not included in public configuration of existing sites
- If something is wrong, just execute “`fedcloud site save-config`” again, that will overwrite local configurations by the default ones from GitHub

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Shell completion

- Quick and dirty approach for activating shell completion

```
$ eval "$(_FEDCLOUD_COMPLETE=bash_source fedcloud)"
```

- A systematic approach

```
$ wget https://raw.githubusercontent.com/tdviet/fedcloudclient/master/examples/fedcloud_bash_completion.sh
$ source fedcloud_bash_completion.sh
```

- After activating shell completion:

```
$ fedcloud site <TAB><TAB>
env             list            save-config     show            show-project-id
```

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4. fedcloudclient container

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Docker container for fedcloudclient

- fedcloudclient container has everything mentioned in the previous section preconfigured:
  - site configuration saved locally
  - oidc-agent installed
  - IGTF certificates installed
  - Shell completion activated
  - jq (JSON processor) installed
  - Useful commands inserted to history
- No additional installation, just pull and use

```
$ docker run -it  tdviet/fedcloudclient bash
```

- See next slides for some useful tips:
  - Using oidc-agent in containers
  - Reusing terminated containers

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Using oidc-agent inside container

- Start fedcloudclient container with the account attached:
  ```
  $ docker run -it -v ~/.config/oidc-agent/egi:/root/.config/oidc-agent/egi tdviet/fedcloudclient bash
  ```
- In the container, start the oidc-agent, load the account and set environment:
  ```
  $ eval `oidc-keychain --accounts egi` && export OIDC_AGENT_ACCOUNT=egi
  ```
- From now, fedcloudclient automatically reads access token from oidc-agent:
  ```
  $ fedcloud openstack server list --site IISAS-FedCloud --vo eosc-synergy.eu
  ```


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Reusing fedcloudclient containers

- It is convenient to reuse a terminated container from previous use as it has everything remembered: command history, customisation, data files, ...
- For reusing the same container, simply give container a name, e.g. fedcloud
  - First time, create a container with the name:
    ```
    $ docker run -it --name fedcloud tdviet/fedcloudclient bash
    ```
  - Exit from container after finishing work. Do not delete it.
  - Every next time, just start the previously terminated container using the name:
    ```
    $ docker start -i fedcloud
    ```

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5. Advanced OpenStack usages

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Show only selected columns

```
$ fedcloud openstack server list --site IISAS-FedCloud --vo eosc-synergy.eu
+--------------------------------------+--------------------------------------------------+--------+-------------
--------------------------------+-------+-----------+
| ID                                   | Name                                             | Status | Networks
| Image | Flavor    |
+--------------------------------------+--------------------------------------------------+--------+-------------
--------------------------------+-------+-----------+
| 973ef1ce-c078-47b6-89ac-f78a99b1b735 | simple-node-103d2e10-1f7c-11eb-9d3e-06bfee50c33a | ACTIVE |
private-network=192.168.10.78, 147.213.76.89 |       | m1.xlarge |
+--------------------------------------+--------------------------------------------------+--------+-----------------
--------------------------+-------+-----------+
```

- Default outputs from OpenStack commands may be too wide, so the tables are broken and difficult to read. Use -c (or --column) option to show only relevant columns

```
$ fedcloud openstack server list -c ID -c Name --site IISAS-FedCloud --vo eosc-synergy.eu
+--------------------------------------+--------------------------------------------------+
| ID                                   | Name                                             |
+--------------------------------------+--------------------------------------------------+
| 973ef1ce-c078-47b6-89ac-f78a99b1b735 | simple-node-103d2e10-1f7c-11eb-9d3e-06bfee50c33a |
+--------------------------------------+--------------------------------------------------+
```

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Output in other formats

```
$ fedcloud openstack server list -f yaml --site IISAS-FedCloud --vo eosc-synergy.eu
Site: IISAS-FedCloud, VO: eosc-synergy.eu
- Flavor: m1.xlarge
  ID: 973ef1ce-c078-47b6-89ac-f78a99b1b735
  Image: ''
  Name: simple-node-103d2e10-1f7c-11eb-9d3e-06bfee50c33a
  Networks: private-network=192.168.10.78, 147.213.76.89
  Status: ACTIVE
```

- Users can choose other formats for output: CSV, JSON or YAML via -f (or --format) option

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OpenStack all-sites commands

```
$ fedcloud openstack server list -c ID -c Name --site ALL_SITES --vo fedcloud.egi.eu
Site: CYFRONET-CLOUD, VO: fedcloud.egi.eu
+--------------------------------------+------+
| ID                                   | Name |
+--------------------------------------+------+
| 2b2883a9-f0f8-43b1-b414-a8bb4212849d | s02  |
+--------------------------------------+------+
Site: IN2P3-IRES, VO: fedcloud.egi.eu
+--------------------------------------+------------------+
| ID                                   | Name             |
+--------------------------------------+------------------+
| 97416d3a-abeb-4a05-9bf8-385e23d24e0d | dev              |
| c559f58c-7065-4e67-bf50-90623938f3a9 | raman-jupyterhub |
+--------------------------------------+------------------+
...
```

- If the value of --site option is ALL_SITES, fedcloudclient will perform the OpenStack command on every site listed in site configurations.
- Parallel execution of OpenStack command on different sites has been implemented in the latest version
- Use option “--ignore-missing-vo” or “-i”for suppressing error messages “VO not found on site”

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Full JSON output

```
$ fedcloud openstack image list --site IISAS-FedCloud --vo eosc-synergy.eu --json-output
[
{
  "Site": "IISAS-FedCloud",
  "VO": "eosc-synergy.eu",
  "command": "image list",
  "Exception": null,
  "Error code": 0,
  "Result": [
    {
      "ID": "4105b4f5-89c3-46d5-97bf-49289652379c",
      "Name": "Image for EGI CentOS 7 [CentOS/7/VirtualBox]",
      "Status": "active"
    },
    ...
  ]
}
]
```

- If option “--json-output” or “-j” is given, the output will be in full JSON format, suitable for further machine processing, parsing, scripting, e.g. with “jq” command.
- Can be used in combination with ALL_SITES. Suppressing other output formats given via “--format”
- Note: not all OpenStack commands can generate JSON output format, e.g. commands for setting properties that have no output

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Automation and programming with fedcloudclient

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Setting OpenStack environments for external tools

- fedcloudclient can be simply used for setting OpenStack environment for external tools (e.g. rclone, openstackclient)

```
$ fedcloud site env --site IISAS-FedCloud --vo eosc-synergy.eu
export OS_AUTH_URL="https://cloud.ui.savba.sk:5000/v3/"
export OS_AUTH_TYPE="v3oidcaccesstoken"
export OS_IDENTITY_PROVIDER="egi.eu"
export OS_PROTOCOL="openid"
export OS_PROJECT_ID="51f736d36ce34b9ebdf196cfcabd24ee"
export OS_ACCESS_TOKEN=...

$ eval $(fedcloud site env --site IISAS-FedCloud --vo eosc-synergy.eu)
```

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Processing JSON output with jq

- jq is a lightweight and flexible command-line JSON processor
- Excellent for processing JSON output from fedcloudclient in scripts
- Example: Select flavors with 2 CPU cores:

```
$ fedcloud openstack flavor list  --site IISAS-FedCloud --vo eosc-synergy.eu --json-output |\
  jq -r  '.[].Result[] | select(.VCPUs == 2) | .Name'
```

- The first command fedcloud prints all flavors in the VO/site in JSON format, the second command jq selects only flavors with 2 cores and prints their name

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More complex JSON processing with fedcloudclient and jq

- Print all available GPU flavors for a given VO on all sites:
  - fedcloud openstack command with “flavor list --long” for all sites in full JSON
  - jq filters:
    - First jq filter: select only sites with error codes == 0, filter out sites with errors
    - Second jq filter: select only flavors with property Accelerator:Type == GPU
    - Third jq filter: select only sites with non-empty result

```
$ fedcloud openstack flavor list --long --site ALL_SITES --vo vo.access.egi.eu -j |\
  jq -r 'map(select(."Error code" ==  0)) |
         map(.Result = (.Result| map(select(.Properties."Accelerator:Type" == "GPU")))) |
         map(select(.Result | length >  0))'
```

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Programming in Python

- Almost all functionalities available via CLI can be called directly from Python
- Demo codes in GitHub:

```
from fedcloudclient.openstack import fedcloud_openstack

token = "YOUR_ACCESS_TOKEN"
site = "CYFRONET-CLOUD"
vo = "fedcloud.egi.eu"
command = ("image", "list", "--long")

error_code, result = fedcloud_openstack(token, site, vo, command)

if error_code == 0:
   print(json.dumps(result, indent=4))
```

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6. More information

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Explore and get helps

```
$ fedcloud
Usage: fedcloud [OPTIONS] COMMAND [ARGS]...

Options:
  --help  Show this message and exit.

Commands:
  endpoint       endpoint command group for interaction with GOCDB and...
  openstack      Executing OpenStack commands on site and VO
  openstack-int  Interactive OpenStack client on site and VO
  site           Site command group for manipulation with site...
  token          Token command group for manipulation with tokens
```

- Try --help option with a command if you need to know more about the command
- Or read documentation https://fedcloudclient.fedcloud.eu/

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Discover interesting features

- Fedcloud client can work flawlessly in Windows. Furthermore, its outputs are adapted to Windows environment, e.g. “`set var=value`” instead of “`export …`”.
- You can use syntax “`--site=<site>`” instead of “`--site <site>`”
- Many shortcut options are supported, e.g. `--all-sites`, `-a` is equivalent to `--site ALL_SITES`
- Validity of access tokens may be checked via “`fedcloud token check`”
- You can work interactively with OpenStack via “`fedcloud openstack-int`”
- There is a script “`list-all-my-own-vms.sh`” included to show all your own VMs on whole EGI Cloud infrastructure
- And still much more …

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More information

- Source code: https://github.com/tdviet/fedcloudclient
- DOI: https://doi.org/10.5281/zenodo.4660391
- Documentation: https://fedcloudclient.fedcloud.eu/index.html
- Cheat sheets (with almost all commands mentioned in this webinar): https://fedcloudclient.fedcloud.eu/cheat.html

- Still more improvements are expected soon, check GitHub issues

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Feedbacks

Please give feedbacks if you can:

- Questions
- Bug reports
- Suggestions for improvements (codes, documentations, tutorial)
- General comments, compliments, critics :-)
- Pull requests

Feedbacks can be submitted directly at GitHub repository or via emails to tdviet@gmail.com. Any kinds of feedbacks are highly appreciated.

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Summary

fedcloudclient is a simple but powerful client tool and library for working with OpenStack sites in EGI Cloud infrastructure.

- For beginners: simple setup, simple usage, intuitive syntax
- For advanced users: many customizations and powerful commands

Let’s try it and learn more

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Thank you for your attention

Questions: tdviet@gmail.com

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